I claim:

1. A method for developing rocket motor burnback profiles at a test firing temperature, comprising the following steps:

receiving input data comprising data from an actual test firing and rocket motor specifications;

selecting a coefficient of throat erosion by iteratively solving an expression for rate of throat erosion as a function of said input data until a throat dimension matches a user input value;

calculating an array of throat dimension by time increment with the selected coefficient of throat erosion;

selecting a reference burn rate by iteratively solving an expression for total web burned as a function of said input data until total linear web burned matches the user input value for web thickness;

calculating an array of linear web burned values at the test firing temperature with the selected reference burn rate

- selecting a characteristic velocity by iteratively solving an expression for total propellant weight burned as a function of said input data until a total propellant weight burned matches a user input value,

calculating an array of burn surface values at the test firing temperature with the selected characteristic velocity; and

developing predicted data profiles for a temperature selected by the user.

2. The method according to claim 1, wherein said step of receiving input data further comprises receiving a firing temperature, initial throat diameter, final throat diameter, pressure versus time and thrust versus time.

3. The method according to claim 1, wherein said rocket motor specifications further include propellant weight, propellant density data for a range of temperatures, web thickness, pressure exponent data for a range of temperatures, thermal expansion coefficient, and temperature sensitivity coefficient.

4. The method according to claim 1, wherein said step of developing predicted data profiles for a temperature selected by the user further comprises the substeps of:

determining an incremental array of linear web burned values, at the temperature selected by the user;

determining an incremental array of burn surface values, at the temperature selected by the user; and

determining an incremental array of burn rates, at the temperature selected by the user.

5. A computer program for predicting rocket motor ballistics performance at a user selected firing temperature, comprising the steps of:

- receiving input of data from at least one test firing, and rocket motor specifications including firing temperature, initial throat dimension, final throat dimension, propellant weight, propellant density data, web thickness, pressure exponent data, and pressure versus time;

- processing the pressure data in an iterative operation, varying a coefficient in an expression for the rate of throat erosion, as a function of pressure, to solve for a final throat dimension and selecting the coefficient of throat erosion which produces a final throat dimension matching the user input value;

- calculating an array of incremental values of throat dimension with the selected coefficient of throat erosion;

- processing the pressure and pressure exponent data in an iterative operation, varying a reference burn rate, in an expression for linear web burned as a function of pressure, reference pressure, reference burn rate and the pressure exponent, to solve for the total linear web burned and selecting the reference burn rate which produces a total linear web burned matching the user input value for web thickness;

-calculating an array of incremental values of burn rate at the test firing temperature and linear web burned at the test firing temperature, with the selected reference burn rate;

- processing the pressure and throat dimension data in an iterative operation, varying a characteristic velocity in an expression for propellant weight burned as a function of pressure, characteristic velocity, and throat dimension to solve for total propellant weight burned and selecting the characteristic velocity which produces the user input value for propellant weight ;

- calculating an array of incremental values of burn surface at the test firing temperature, with the selected characteristic velocity;

- processing the arrays of values at the test firing temperature, for incremental throat dimension, linear web burned, and burn surface using equations expressing temperature dependence of the linear web burned and burn surface said equation expressing temperature dependence of burn surface including a burn surface modifier, and repeatedly solving equations for incremental values at the temperature selected by the user, in an iterative operation varying the burn surface modifier, in an equation for total propellant weight burned and selecting the burn surface modifier which generates a propellant weight burned matching the user input value of propellant weight,;

-calculating an array of incremental values of linear web burned and an array of incremental values of burn surface, using the selected burn surface modifier, both at the user selected temperature;

- combining the burn surface values with the linear web burned values to form a burnback profile of the rocket motor, for the temperature selected by the user.

6. The method of Claim 5 wherein the equation for total propellant weight burned is a function of burn surface, including the burn surface modifier and is a function of burn rate values which are generated from the pressure exponent data.

7. The method of Claim 5, further comprising the steps of:

- receiving thrust versus time data for the test firing temperature;

processing the thrust and pressure data with the array of throat dimension values to solve an equation for a thrust coefficient as a function of thrust, pressure and throat dimension to yield an array of incremental thrust coefficient values, at the test firing temperature.

- processing the reference burn rate, at the test firing temperature in an expression for the burn rate, at the temperature selected by the user as a function of pressure, at a preceding increment, and the pressure exponent to yield an array of burn rates, for integer numbered increments, at the temperature selected by the user;

processing the arrays of values for burn surface, burn rate, both at the temperature selected by the user, and throat dimension in an expression for pressure as a function of burn surface, burn rate and throat dimension to solve for an array of pressure values at the temperature selected by the user;

- processing the arrays of linear web burned and burn rate, at the temperature selected by the user in an expression for the time increment as a function of the linear web burned and the burn rate to solve for an array of integer numbered time increments and assigning the resulting time values to the integer numbered increments in the arrays for the temperature selected by the user;

8. The method of Claim 7, further comprising the step of solving an equation for thrust coefficient at the temperature selected by the user as a function of the thrust coefficient at the firing temperature and the difference in temperatures, to yield an array of thrust coefficients at integer numbered increments and assigning said resulting time values to the increments and

solving for incremental thrust in an equation for incremental thrust as a function of incremental chamber pressure, incremental throat dimension and incremental thrust coefficient, to yield an array of incremental thrust values for the temperature selected by the user.

9. The method of claim 5, wherein said step of processing the arrays of values includes using an equation expressing temperature dependence of the incremental throat dimension.

10. A method for predicting rocket motor ballistic performance at a user-selected firing temperature, comprising the steps of:

developing rocket motor data profiles at an actual test firing temperature, said data profiles including an array of incremental thrust coefficient values at the actual test firing temperature; and

developing predicted rocket motor data profiles for a user-selected temperature , said predicted rocket motor data profiles including an incremental array of thrust values as a function of thrust coefficient, pressure and throat dimension;

wherein said rocket motor ballistic performance is predicted without the need for knowing an actual propellant grain geometry.

11. The method according to claim 10, wherein said step of developing rocket motor data

profiles at an actual test firing temperature further comprises the substeps of:

- receiving input of data from at least one test firing, including firing temperature, initial throat dimension, final throat dimension, propellant weight, propellant density, web thickness, pressure exponent data, pressure versus time and thrust versus time;

- processing the pressure data in an iterative operation, varying the coefficient in the expression for the rate of throat erosion, as a function of pressure, to solve for the final throat dimension and selecting the coefficient of throat erosion which produces a final throat dimension matching the user input value;

- calculating an array of incremental values of throat dimension with the selected coefficient of throat erosion;

- processing the pressure and pressure exponent data in an iterative operation, varying the reference burn rate, in an expression for linear web burned as a function of pressure, reference pressure, reference burn rate and the pressure exponent, to solve for the total linear web burned and selecting the reference burn rate which produces a total linear web burned matching the user input value for web thickness;

- calculating an array of incremental values of linear web burned with the selected reference burn rate;

- processing the pressure and throat dimension data in an iterative operation, varying a characteristic velocity in an expression for propellant weight burned as a function of pressure,

throat dimension and characteristic velocity and selecting the characteristic velocity which produces the propellant weight burned matching the user input value for propellant weight;

- calculating an array of incremental values of burn surface with the selected characteristic velocity.

12. The method according to claim 11, wherein said step of developing predicted rocket motor data profiles for a user-selected firing temperature further comprises the substeps of:

- receiving input of pressure exponent data, thermal expansion coefficient and arrays of incremental data from a test firing at a test firing temperature including incremental throat dimension, incremental linear web burned, incremental burn rate and incremental burn surface;

- processing the array of values for incremental thrust coefficient using an equation expressing temperature dependence and calculating an array of thrust coefficient values at the user selected temperature;

- processing the arrays of values at the test firing temperature in expressions for linear web burned and burn surface, both at the user selected temperature, said expression for burn surface including a burn surface modifier having a default value, to calculate arrays of linear web burned and burn surface at the user selected temperature;

- processing the pressure exponent data to calculate an array of burn rate values at the user selected firing temperature using an expression for burn rate as a function of pressure at a next prior increment, wherein said process includes calculating a pressure value for use as a pressure

value at a next prior increment by solving an expression for pressure as a function of burn rate, burn surface and throat dimension;

- solving an equation for propellant weight burned repeatedly in an iterative process varying the burn surface modifier and selecting the burn surface modifier which produces a propellant weight burned matching the user input propellant weight;

- processing the arrays of linear web burned and burn rate, both at the user selected temperature in an expression for incremental time, assigning time increments to arrays of values for linear web burned, burn surface, burn rate, throat dimension and thrust coefficient and recalculating the arrays of values using the selected burn surface modifier; and

- processing the arrays of values for thrust coefficient throat dimension, burn rate and burn surface in an expression for thrust, to calculate an array of time incremental thrust values for the user selected temperature.

13. The method of Claim 12 wherein the array of values for throat dimension at the user selected temperature is generated from an equation expressing temperature dependence of throat dimension.

14. A method for predicting rocket motor ballistic performance at a user-selected firing temperature, comprising the steps of:

inputting an actual throat diameter of a rocket motor;

inputting a value for web burned;

measuring pressure data at a test firing of said rocket motor;

using said measured pressure data in a predetermined throat diameter equation and varying coefficients therein until a calculated final throat diameter matches said actual throat diameter;

using the measured pressure data in a predetermined web burned equation and varying a reference burn rate therein until a calculated web burned matches said user input value for web burned;

using the measured pressure data, calculated web burned, and calculated throat diameter to derive a burnback profile.

15. The method according to claim 14, comprising an additional step of using said burnback profile to iteratively generate output pressure and thrust versus time data at a selected output temperature.